



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/856,966	09/06/2001	Peter A. Dowben	UNVN.62457/0	5124

7590

03/27/2002

Michael J Gross
Shook Hardy & Bacon
One Kansas City Place
1200 Main Street
Kansas City, MO 64105-2118

EXAMINER

PALABRICA, RICARDO J

ART UNIT

PAPER NUMBER

3641

DATE MAILED: 03/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/856,966

Applicant(s)

DOWBEN ET AL.

Examiner

Rick Palabrica

Art Unit

3641

-- Th MAILING DATE of this communication app ars on th cov r sh et with the correspond nc addr ss --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:
 - On page 1, "Cross Reference to Related Applications," there is no recitation that the application is a 371 of a PCT application.
 - Figs. 4, 5 and 6 are enclosed but not discussed in the specification.Appropriate correction is required.
 - On page 5, last line and page 6, first two lines, the disclosure recites a plot of counts in Fig. 3, but said figure shows current vs. applied voltage.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 2, 3 and 13 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Said claims pertain to a homojunction diode wherein the sensing mechanism is inherent in the boron

carbide semiconductor layer. The disclosure, including all accompanying figures (1-6) all pertain to a heterojunction diode and not to a homojunction diode.

3. Claims 2, 3 and 13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. There is no written description and enabling disclosure regarding the homojunction in the limitations of said claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

4. Claims 1, 4-7, 9, 11 and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. patent 5,940,460 to Seidel et al. (see Fig. 2 and corresponding part of the specification). Seidel discloses an array of semiconductor neuron detectors capable of measuring a wide range of neuron fluxes ranging over several orders of magnitude (see column 1, last 2 paragraphs).

Seidel discloses In Fig. 2 a neutron detector (10) that includes a substrate (12) made of a semiconductor material such as silicon. The neutron detector includes a neutron converter layer (22) which generates charged particles when the layer is impinged by neutrons, and suitable materials for said layer include boron carbide (B_4C) – see column 5, lines 1-15. Said neutron converter layer has a preferred thickness of 0.1-22 microns which anticipates the thickness limitation in claim 6 of 1000nm (1 micron)- see column 5, line 31. This layer may be deposited directly on the semiconductor active region (C) -see column 5, lines 18-20. The thickness of semiconductor layer C ranges from about 0.1-5 microns, which anticipates the thickness limitation in claim 7 of less than 600 nm (0.6 microns).

As to the limitation in claim 11 of the device being able to operate at 500°C, Seidel's neutron detector will inherently be capable of operating at said temperature because it is made of the same materials as that claimed by the applicant. Also, Seidel discloses that his use of high temperature resistant materials such as silicon carbide in the active region of the detector permits extended use in high temperature environments such as nuclear reactors.

As to applicant's claim 12 regarding the method of detecting neutrons, Seidel discloses the same inventive concept of detecting said neutron fluxes including the steps of placing said detector array having multiple semiconductor neutron detectors in a neutron flux field, and receiving electronic pulses from the neutron detector array which

are indicative of the level of neutron flux (see column 2, 1st paragraph and claims 12-23).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 8 and 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Seidel. Seidel discloses the applicant's inventive concept except for the use of at least 80% boron-10 and a configuration of at least two diodes interleaved with a neutron absorber. As to the use of boron-10 enriched to 80%, this is a well-known expedient in the nuclear art to enhance the neutron detection efficiency of boron by increasing the boron-10 isotope above the natural enrichment of 20%. As to the use of two diodes interleaved with a neutron absorber, this is also a conventional application in the nuclear spectrometry art wherein two semiconductor detectors are used in combination with a coincidence circuit, the latter for purposes of eliminating background.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the neutron semiconductor detector, as disclosed by Seidel, to use 80% boron-10 enrichment for the neutron converter layer and two diodes interleaved with a neutron energy absorber, as this is no more than the application well-known techniques in radiation detection within the nuclear art.

Art Unit: 3641

6. Claims 1 and 4-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. patent 5,707,879 to Reinitz in view of Seidel and conventional art. Reinitz discloses the applicant's inventive concept except for the use boron carbide and the specifics on its thickness, the use of at least 80% boron-10 enrichment, the specifics on the thickness of the silicon substrate, and a configuration of at least two diodes interleaved with a neutron absorber.

Reinitz discloses a solid-state device for detection and measurement of neutron radiation using a semiconductor material for the detecting medium (see Figs. 1-11 and corresponding parts of the specification). His detector, as well as Seidel's, are based on the same inventive concept claimed by the applicant, i.e., the collection of electron-hole pairs generated by radiation in a region of material depleted of charge carriers. Reinitz discloses a semiconductor slab (15) that is populated with He-3. This slab can be an element such as silicon (see column 3, lines 32-33). In Fig. 9, Reinitz discloses that when a He-3 atom in the substrate captures a neutron (25), a tritium ion (26) and a proton (27) are generated (see also column 4, Section 4). These generated particles give rise to electron-hole pairs that are withdrawn from the material by the reverse biased electric field over the p-n junction (see Fig. 10). Charge sensitive amplifiers (31) convert the charges to pulses

Seidel teaches the use of boron-neutron interaction to produce the charged particles that generate the electron-hole pairs, instead of the helium-neutron interaction in Reinitz. Additionally, as discussed in Section 5 above, the use of boron-10 enriched to 80%, this is a well-known expedient in the nuclear art to enhance the neutron detection efficiency. The use of two diodes interleaved with a neutron absorber is also a conventional application in the nuclear spectrometry.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the neutron semiconductor detector, as disclosed by Reinitz, to substitute an 80% enriched boron layer for the helium-3 material, and use the thickness teachings of Seidel for the boron coating and silicon substrate, to obtain a neutron detection device comprising: a sensing mechanism having a 1000 nm thick layer of boron carbide that is coated on a silicon layer of less than 600 nm thickness, a monitoring device that record changes to the boron carbide layer, and two of said detectors being interleaved with a neutron energy absorber. This modification is no more than the utilization of conventionally known techniques of semiconductor neutron detection in the nuclear art.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References C and D pertain to solid state neutron detectors and are relevant to the inventive concept of the application.

• Art Unit: 3641

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rick Palabrica whose telephone number is 703-306-5756. The examiner can normally be reached on 8:00-4:30, Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Carone can be reached on 703-306-4198. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-0285 for regular communications and 703-305-0285 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

RJP
March 20, 2002



MICHAEL J. CARONE
SUPERVISORY PATENT EXAMINER